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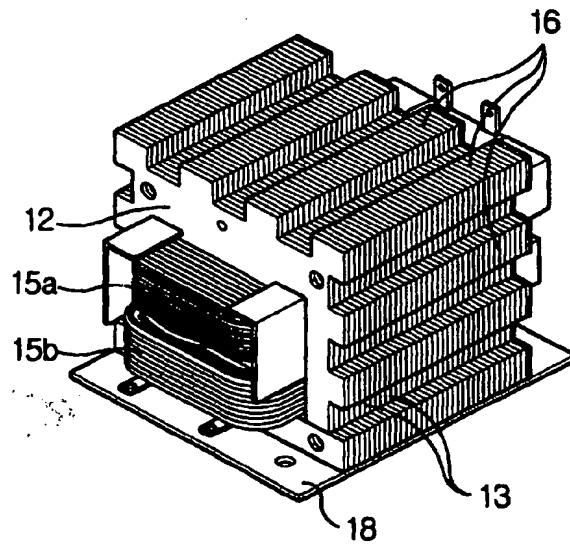
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(54) High-voltage transformer with cooling ribs

(57) A high-voltage transformer has a laminated core (12). The laminations (13) of the core (12) have projections (17) which together form longitudinal cooling ribs (16).

FIG.3



Description

[0001] The present invention relates to a high-voltage transformer comprising a laminated core and cooling means.

[0002] High-voltage transformers (HVT) are used in microwave oven to step up the mains voltage (110V, 220V or 240V) to a high voltage suitable for driving a magnetron.

[0003] Conventionally, such high-voltage transformers have a laminated core, comprising a plurality of iron laminations arranged side by side, and primary and secondary windings wound on the laminated core. Each iron lamination comprises an E-shaped iron plate and an I-shaped iron plate, joined to the E-shaped plate across the ends of its arms. When an alternate current (AC) is passed through the primary winding, a voltage is induced in the secondary winding. The induced voltage is determined by the turns ratio of the primary and secondary windings.

[0004] During operation, high-voltage transformers generate because of coil resistance, hysteresis core losses, and eddy current losses. Such generated heat is a problem because it causes degradation of insulation. Consequently, heat radiating means has been provided on high-voltage transformers. In KR-A-98-6654, a transformer having cooling fins 3 is described. The fins 3 are formed by plates placed between laminations at predetermined intervals as shown in Figure 1. GB-A-914857 discloses a transformer having asymmetric E-shaped plates 4. Referring to Figure 2, each E-shaped plate 4 has a thick outer arm 4a and a thin outer arm 4b. The laminations are grouped together and the groups are brought together so that the thick arms 4a protrude first on one side of the core and then on the other to form cooling fins 5.

[0005] The transformers described above suffer from complicated assembly processes requiring insertion of fins or arranging groups of laminations in different orientations.

[0006] Embodiments of the present invention will now be described, by way of example, with reference to Figures 3 to 6 of the accompanying drawings, in which:-

Figure 1 is a perspective view of a prior art high-voltage transformer;

Figure 2 is a perspective view of another prior art high-voltage transformer;

Figure 3 is a perspective view of a high voltage transformer according to the present invention;

Figure 4 is a perspective view for showing a lamination from the core of the transformer shown in Figure 3; and

Figures 5 and 6 are perspective views of details of alternative forms of lamination for a transformer according to the present invention.

[0007] Referring to Figures 3 and 4, a high voltage

transformer includes a laminated core 12, primary and secondary windings 15a, 15b, a plurality of longitudinal cooling ribs 16 and a base plate 18 for supporting the high-voltage transformer and fixing it to another member.

[0008] The laminated core 12, as shown in Figure 4, is formed by bringing together a plurality of laminations forms from E- and I-shaped plates 13a, 13b in the conventional manner. The primary and secondary windings 15a, 15b are mounted about the middle arms 14 of the E-shaped plates 13a.

[0009] The cooling ribs 16 extend perpendicular to the laminations 13 on both sides and the top of the core 12. The cooling ribs 16 are formed as the laminations 13 are brought together by similarly positioned protrusions 17 on the outer peripheries of the E-shaped plates 13a. The protrusions 17 are rectangular in cross-section. However, as shown in Figures 5 and 6, other shapes can be used, e.g. wavy and triangular. Nevertheless, the rectangular form is preferred as it performs best of the illustrated forms.

[0010] It can be seen that a transformer according to the present invention avoids the manufacturing difficulties associated with the prior art transformers described above.

Claims

1. A high-voltage transformer comprising a laminated core (12) and cool means (16), characterised in that the cooling means (16) comprises a plurality of protrusions (17; 17'; 17'') from laminations (13) of the core (12), the protrusions being aligned to form an elongate structure (16) projecting from the core (12) and extending perpendicular to the laminations (13) thereof.
2. A transformer according to claim 1, wherein the cooling means (16) comprises a plurality of elongate structures (16) projecting from the core (12) and extending perpendicular to the laminations (13) thereof, each said structure (16) comprising a plurality of aligned protrusions (17; 17'; 17'') from laminations (13) of the core (12).
3. A transformer according to claim 2, wherein each lamination (13) has a plurality of protrusions (17; 17'; 17'') contributing to respective ones of said elongate structures (16).
4. A transformer according to claim 1, 2 or 3, wherein the cross-section of the or each said elongate structure (16) is rectangular.
5. A high voltage transformer, comprising:

a laminated core formed of a plurality of iron plates which are accumulated one over

another;
first and second windings wound in the laminated core and for converting an input voltage to a predetermined output voltage; and
a plurality of radiation ribs formed in the accumulated direction of the plurality of iron plates on the outer periphery of the laminated core.

6. The high voltage transformer as claimed in claim 5,
wherein the plurality of radiation ribs are formed as the plurality of iron plates are accumulated, by the accumulation of a plurality of protrusion portions formed along each of the plurality of iron plates. 10
7. The high voltage transformer as claimed in claim 5, 15
wherein the plurality of radiation ribs have cross sections of a rectangular shape in order for the surface area to be maximized.

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FIG.1

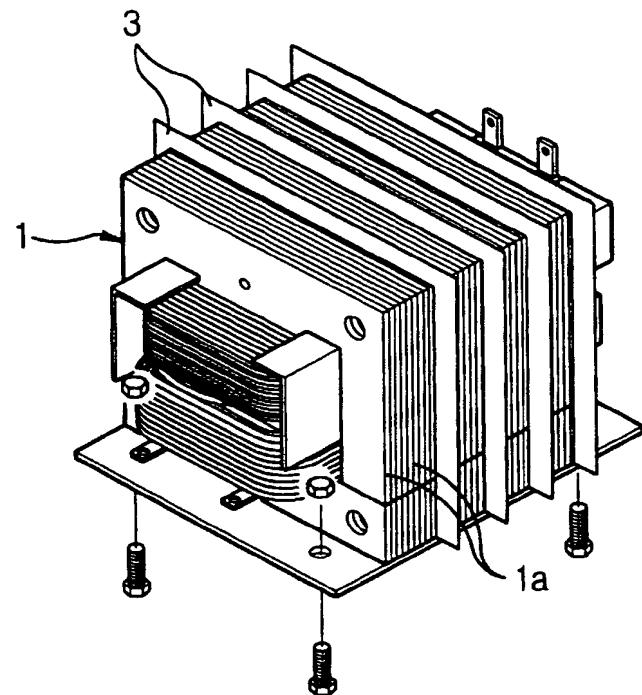


FIG.2

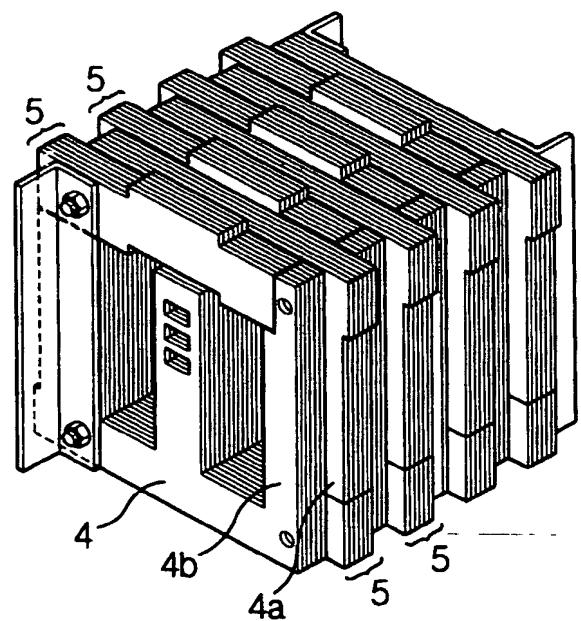


FIG.3

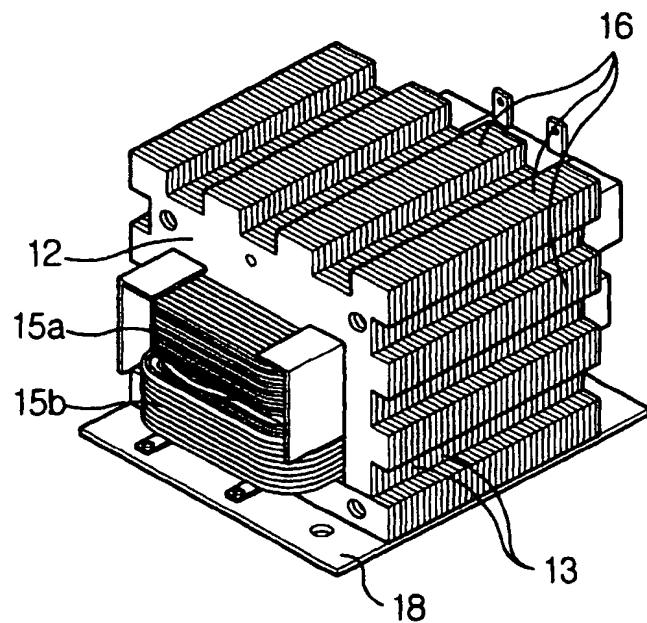


FIG.4

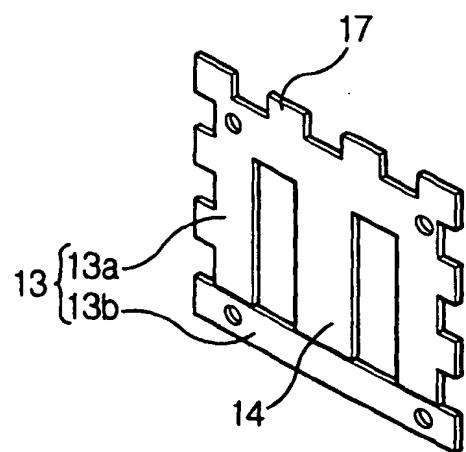


FIG.5

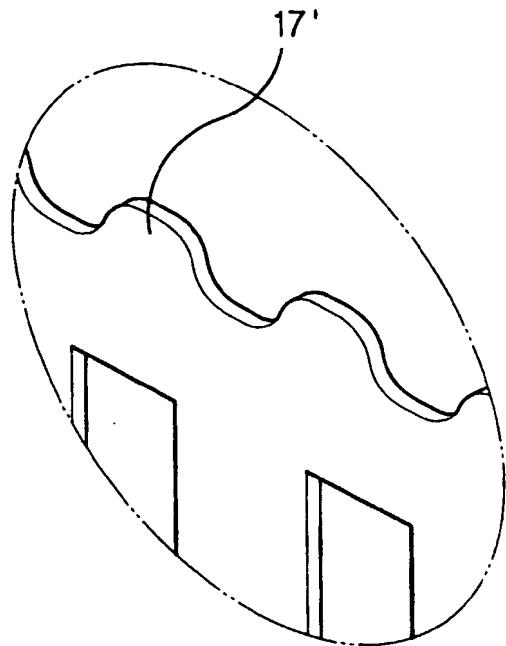
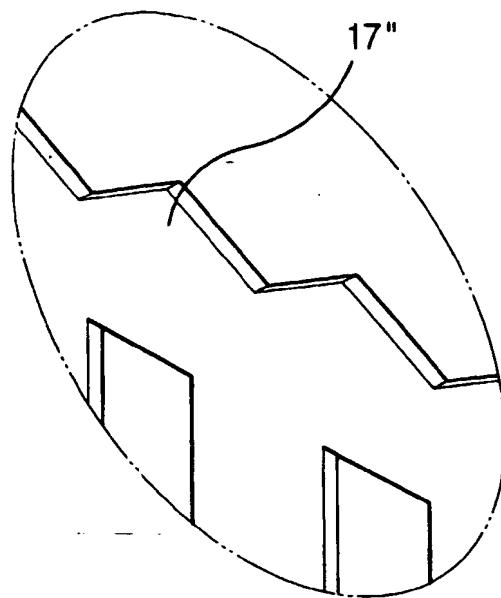
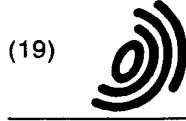


FIG.6





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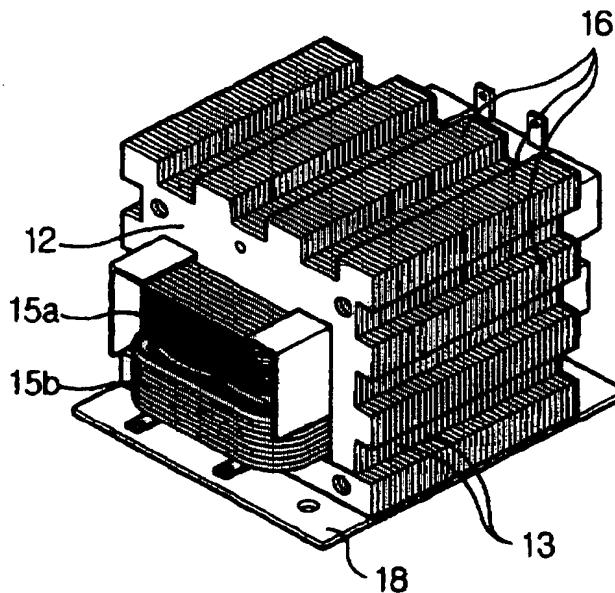
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FIG.3





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EUROPEAN SEARCH REPORT

Application Number
EP 99 30 7591

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H01F			
The present search report has been drawn up for all claims			
Place of search THE HAGUE	Date of completion of the search 1 August 2001	Examiner Vanhulle, R	
CATEGORY OF CITED DOCUMENTS			
X : particularly relevant if taken alone Y : particularly relevant if combined with another document of the same category A : technological background O : non-written disclosure P : intermediate document			
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ON EUROPEAN PATENT APPLICATION NO.**

EP 99 30 7591

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01-08-2001

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